Chapter 3. Strategy[1]

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The word "strategy" has been in use since Sun Tzu wrote the *Art of War* in the fourth century B.C. (Sun Tzu 1971). Sun Tzu wrote, of course, about *military* strategy. The literature on *corporate* strategy, which emerged in the 1950s and 1960s (Chandler 1962; Ansoff 1965; Learned et al. 1965) is vast and continues to grow at an astonishing rate. S*trategic management* – the way in which a firm identifies its strategic direction and aligns its operational processes to its strategy – has become an academic discipline in its own right, like marketing and finance (Mintzberg et al. 1998:18; Rumelt et al. 1994:15). In essence, strategy has to do with understanding where an organization will go in the future and how it will get there. Most academicians and corporate managers believe strategy affects the overall welfare of the corporation, and strategy making is an important activity, though a few believe firms are better off without a strategy (see Inkpen and Choudhury 1995). Many who believe strategy is important, however, find fault with the ability of formalized *strategic planning processes* to deal adequately with the pace of change facing organizations in today's environment.

The disruptive changes created by revolutionary technologies (including communication and information processing technologies), globalization, and new business methods can turn an organization's current advantages into barriers for future success and have led to new thinking about the focus and goal of strategy (Christensen and Overdorf 2000; Miller and Morris 1999; D'Aveni 1994; Brown and Eisenhardt 1998; Tushman and Anderson 1997). D'Aveni (1994) and Dudik (2000) argue that under the dynamic conditions affecting many organizations today, which D'Aveni calls *hypercompetition*, strategy that seeks to *sustain* organizational advantage needs to be replaced with strategy that seeks to establish flexibility and the ability to disrupt the advantages of competitors. This perspective places an emphasis on *competition* and the ability of the organization to change the rules of the game or the game it chooses to play. Consequently, the pace of change has placed greater emphasis on developing strategies that can successfully take advantage of changing situations rather than on designing *a* single strategy for success.

Public science organizations find themselves in a challenging position. On the one hand, they are participating at the cutting edge of knowledge, where the goal is to achieve transforming breakthroughs in theory, materials, processes, and/or tools and to utilize breakthroughs achieved by other research organizations. They must be able to be agile in determining managing their current scientific direction and future science strategies. On the other hand, they tend to be embedded in large-scale institutions that are permeated by cumbersome, slow, and change-resistant procedures and political processes.

This review addresses definitions of strategy, approaches to strategy development, tools typically used in strategy development, problems with strategic planning, and the role of strategic planning in government. It concludes by discussing the implications of this literature for managing publicly funded science programs and science organizations.

[1] Related chapters include: Science Policy; Change Management, Competencies; Organizational Culture; Leadership; Organizational Communication; Innovation.

Definitions of Strategy

Many strategic management textbooks exist, each with its own definition of strategy. For instance, Mintzberg and Quinn (1996:3) define a strategy as

> the *pattern* or *plan* that integrates an organization's *major* goals, policies, and action sequences into a *cohesive* whole. A well-formulated strategy helps to *marshal* and *allocate* an organization's resources into a *unique* and *viable* posture based on its *relative internal competencies* and *shortcomings*, anticipated *changes in the environment* and contingent moves by *intelligent opponents* (emphasis included in the original).

Thompson and Strickland (1993:6) define strategy as "the pattern of organizational moves and managerial approaches used to achieve organizational objectives and to pursue the organization's mission." Michael Porter (1996) states: "The essence of strategy is choosing to perform activities differently than rivals do." D'Aveni (1994) takes the view that strategy is not only the creation of advantage but "also the creative destruction of the opponent's advantage." Brown and Eisenhardt (1998:4) define strategy as "the creation of a relentless flow of competitive advantages that, taken together form a semi-coherent strategic direction."

In their recent book, Mintzberg et al. (1998:9) contend, "[S]trategy is one of those words that we inevitably define in one way yet often also use in another." Most people think of strategy as a *plan* – a direction, a guide, or course of action into the future. But when asked to describe a strategy actually pursued, people tend to describe a *pattern* or a set of behaviors over time, e.g., a company that perpetually markets the most expensive products is said to pursue a "high-end strategy." So strategy can be defined as a pattern of behavior. Mintzberg et al. include several other ways of defining strategy: Strategy is "position" – selling particular products in particular markets. Strategy is "perspective" – an organization's fundamental way of doing things, e.g., the "McDonald's way." Strategy is "ploy" – a specific maneuver intended to outwit a competitor. The five P's (plan, pattern, position, perspective, and ploy) serve as a key aspect of Mintzberg et al.'s framework for analyzing different schools of thought about strategy.

Strategy and Organizational Design

The concepts of organizational design and the resource theory of the firm have greatly influenced recent discussions of strategy. It is generally recognized that a good fit between strategy, organizational design, and external opportunity creates a competitive advantage for an organization (Galbraith et al. 1993; Galbraith 1994; Tushman et al. 1997:583).[2] An appropriate organizational design is generally viewed as enabling "an organization to execute better, learn faster, and change more easily" (Mohrman et al. 1995:7). An organization's design comprises multiple, interrelated elements, frequently categorized as structure, people, processes, rewards, and tasks or work systems that together can create unique organizational capabilities that provide competitive advantage (Quinn et al. 1997; Galbraith 1994, 1995). Although the classic bureaucratic form may be the form of choice in a stable environment with low complexity, research has shown that rapid change and increased complexity require greater lateral mechanisms and a more organic form (Galbraith 1973, 1994; Burns and Stalker 1961; Hall 1962).

[2] D'Aveni (1994:31) disputes this on the grounds that it implies permanence. He says that organizations need to prepare for hypercompetition in an entirely different way, focusing on creating disruption, seizing the initiative, and creating a series of temporary advantages.

In hypercompetitive industries, organizations increasingly compete on the basis of being "good at combining difficult-to-combine organizational capabilities" (Galbraith and Lawler 1998:5) and being able to adjust its strategies to take advantage of or create new opportunities. Agile organizational designs are being emphasized, such as team-based organizations, competency-based organizations, and the notion of generalized product platforms that effectively manage product portfolios, shortened product life cycles and the need for more rapid new product development.

How Strategy Is Developed: Alternative Approaches to Strategic Development

Thinking about strategy formulation has evolved over the last 40 years. Early concepts revolved around the premise that the executive officer could design a strategy based on a careful analysis of both internal and external factors affecting the firm's competitiveness, and that this strategy should then be implemented by the firm. Organizations went to great lengths (and expense) in the 1970s to develop a whole system of integrated plans at all levels of the organization to make sure corporate strategy was developed and embedded in all activities. Porter's (1980) analytic five-forces approach to industry analysis made strategy more externally focused. It had a very strong influence in the 1980s (and remains quite influential). After 1990 the emphasis has been on the need for speed and flexibility in order to respond to the increased pace of change and its effects on competition. The field has become far more eclectic, and confidence in the ability of top management to develop an effective strategy using a purely analytical approach has been largely shattered. The concepts of grassroots strategy development, collective strategy, the learning organization, competency-based strategy, negotiation, and incorporating trial and error in strategy development all recognize that a wide range of players, including employees, customers, and even competitors, need to play a role in developing and shaping strategy.

Current approaches to strategy development, consequently, draw upon a wide range of ideas and models. Mintzberg and Lampel (1999) and Mintzberg et al. (1998) identify the following nine *schools of thought* that fall into two fundamental types:

- *Prescriptive* (in which normative assumptions derive from a view that the environment is relatively constant and the challenge for strategy development is to respond or adjust to the environment)
  - Design school
  - Planning school
  - Positioning school
- *Descriptive* (in which the approach is derived from empirical findings or disciplinary perspectives and methods)
  - Entrepreneurial school
  - Cognitive school
  - Learning school
  - Cultural school
  - Political school
  - Environmental school.

It is impossible in a short review to summarize the whole body of work, but a sample of ideas and models about how organizations do or should formulate strategy is presented below. One of the

classic models for developing strategy, known as the SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis and called the "Design School Model" by Mintzberg et al. (1998), emerged from early writings by Philip Selznick (1957), Alfred Chandler (1962), and a group at the Harvard Business School (Learned et al. 1965[3]), among others. As shown in Figure 1, this model requires that upper management conduct an internal appraisal (to understand the organization's competencies, strengths, and weaknesses) and an assessment of the external environment (to determine threats and opportunities based on competitive, economic, market, societal, governmental changes), then deliberately choose a tailored, unique course of action based on sound reasoning and firm-specific conditions. The beliefs and preferences of the leaders of the organization and ethical considerations, also shown in Figure 1, often influence the choice of strategic direction.

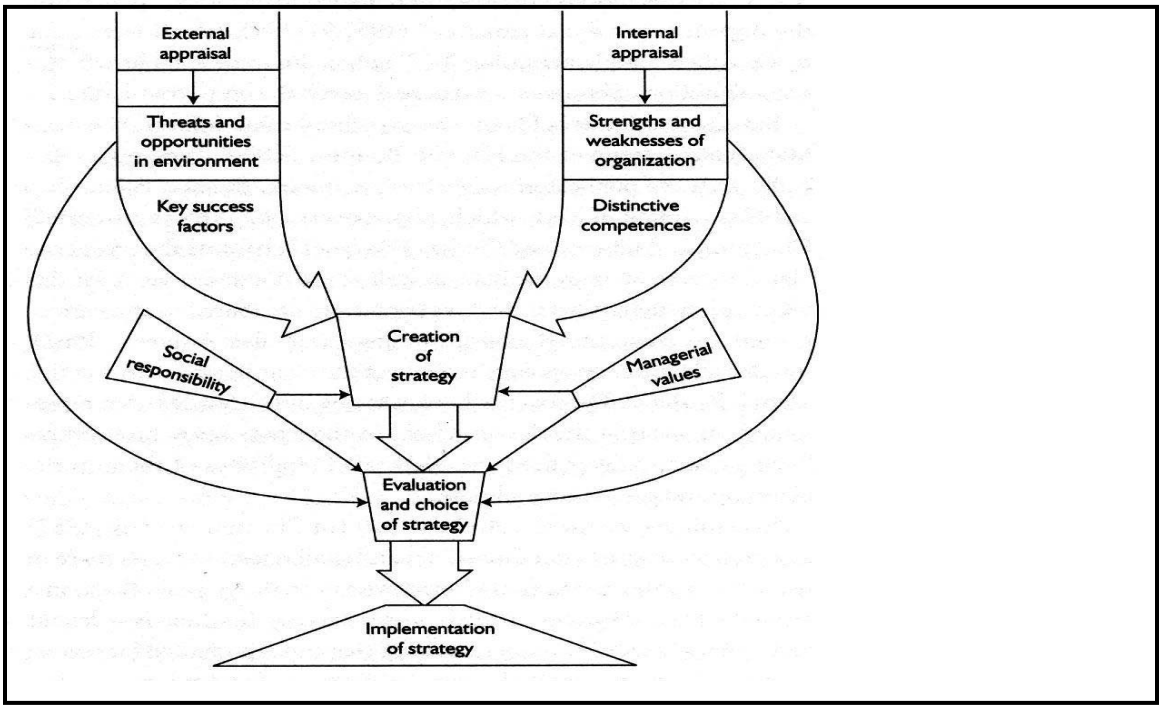

Figure 1. The Design School Model of Strategy Formation (Mintzberg et al. 1998:26)

This process was taken one step further by Ansoff (1965) and others, who took the basic SWOT model and divided it into neatly delineated steps, including a plethora of checklists and techniques linking the setting of goals to the budgeting and operating plans of all levels within the organization. This "planning school" approach is both described and critiqued by Mintzberg (1994). An example of such a detailed planning process (at General Electric Corporation) is shown in Figure 2. The belief behind this approach is that strategy should result from a controlled, conscious process of formal planning based on extensive data collection and analysis, the product of which can be implemented through detailed specification of objectives, budgets, programs and operating plans of various kinds. This highly detailed, integrated, data-intensive

[3] Andrews is most often cited as the thought leader behind the SWOT analysis. His classic book, *The Concept of Corporate Strategy*, published first in 1971, presented a powerful insight about strategy as the subset of what a company can do within the universe of what it might do.

approach to strategy development was used extensively in the 1970s, until its usefulness came into question. A balanced view, representing both the merits and limitation of such formalized processes, is provided by Hax and Majluf (1996).

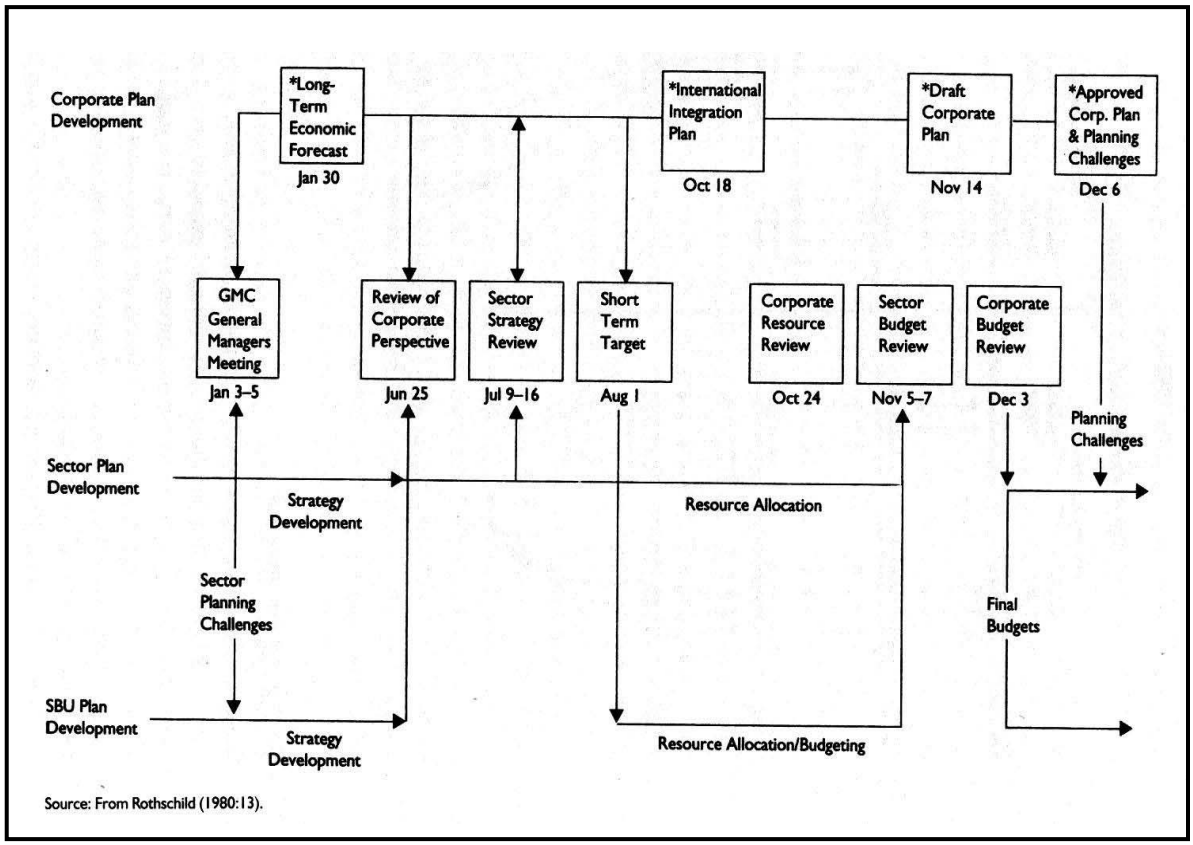

Figure 2. Strategic Planning Process at General Electric Corporation (from Mintzberg et al. 1998: 55)

Somewhat later, Michael Porter (also from the Harvard School) focused more systematically on external forces and the changing nature of competition within the industry to which the firm belongs. His model, commonly called the "Five Forces," belongs to the "positioning school." As shown in Figure 3, it consists of: (1) the internal rivalry among existing players in the industry, (2) the threat of new entrants (firms) to the industry; (3) the bargaining power of suppliers, (4) the bargaining power of buyers (customers), and (5) the threat of substitute products (Porter 1980, 1991). To deal with these forces, firms must make a choice among possible "generic" strategies such as becoming the low-cost provider, differentiating the product (making it unique), developing a high degree of customer loyalty, or focusing on narrow market segments. Firms should avoid the strategy of "being all things to all people." Porter's model of competitive analysis became the dominant strategy approach (Mintzberg et al. 1998:82) and continues to be a strong force in business education today.

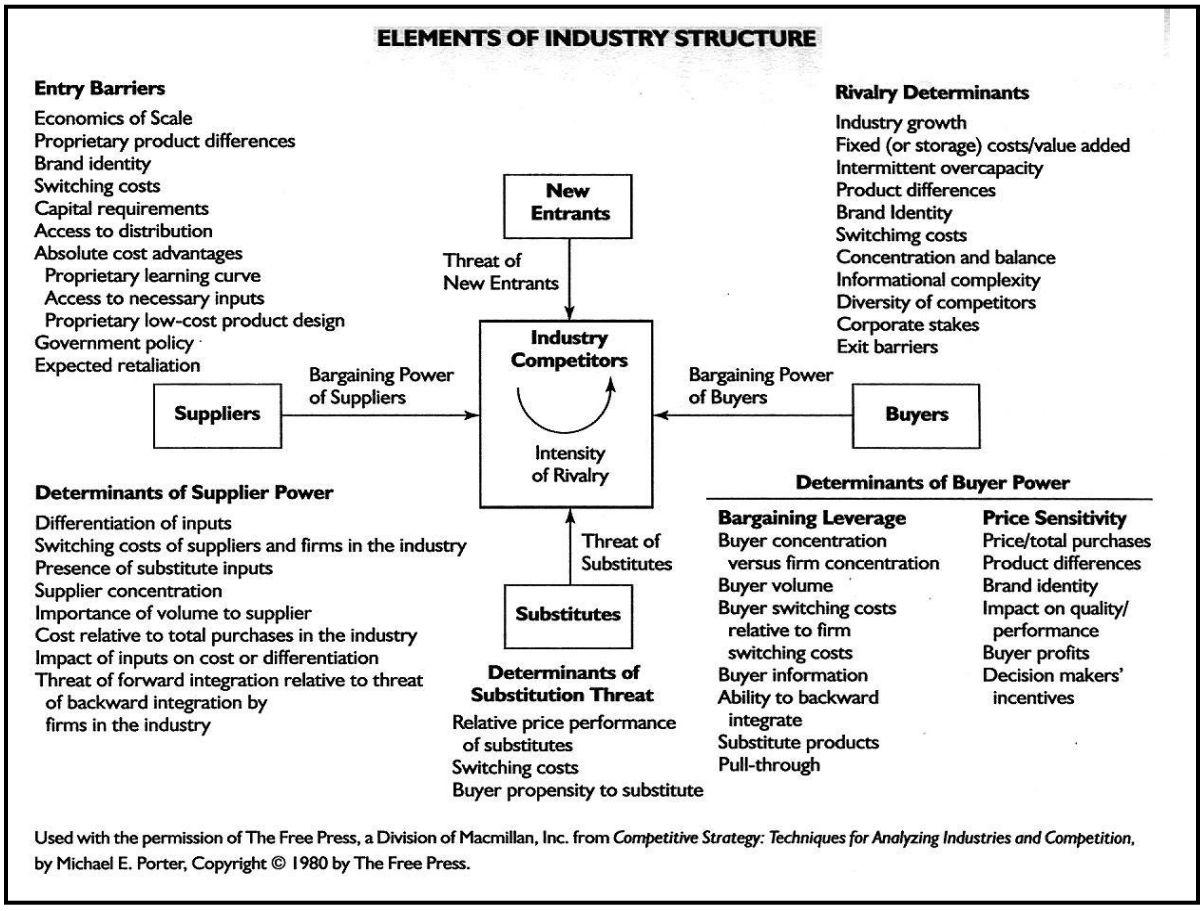

Figure 3. The Five Forces Shaping Strategy (Montgomery and Porter 1991:12)

Hamel and Prahalad (1993, 1994) complement Porter's focus on external, industry analysis as the key to strategy with an emphasis on a *dynamic capabilities* approach to strategy development, in which the roots of competitive advantage are found in the core competencies of the firm. Strategy is the ability to stretch and leverage those competencies (see Chapter 7: Competencies). According to Hamel and Prahalad, strategic management is a *collective learning* process aimed at developing and exploiting distinctive competences that are difficult to imitate. This view is reinforced by D'Aveni (1994), Brown and Eisenhardt (1998) and Galbraith and Lawler (1998), who also emphasize the need to develop an organizational design that enables the flexible development and recombination of these capabilities.

Hamel and Prahalad (1989) further offer the concept of *strategic intent*, in which the organization envisions its desired leadership position and uses that vision to set direction, define emerging market opportunities, serve as the rallying cry for employees, and establish the criteria the organization will use to chart its progress. Kay's (1995:6) study of organizational success presents a similar framework: successful strategies are based on recognizing the organization's distinctive capabilities, identifying a market in which these capabilities provide a competitive advantage, and focusing its business on maximizing the value of that competitive advantage.

Combining ideas from both Porter (with the industry analysis or external focus) and Hamel and Prahalad (with the capabilities and learning focus), Collis and Montgomery (1999) developed a *resource-based view* of the firm, which saw "capabilities and resources as the heart of a company's competitive position," subject to the interplay of three fundamental market forces: (1) demand (does it meet customers' needs and is it competitively superior?), (2) scarcity (is it imitable or substitutable, and is it durable?), and (3) appropriability (who owns the profits?). This approach provides guidance on how to identify and assess the resources of the organization and their ability to enable the organization to compete successfully.

James Brian Quinn (1980) discusses *logical incrementalism*, which describes the phenomenon of developing a consistent pattern among decisions made in the series of "subsystems" present in an organization, e.g., the subsystems for diversification, external relations, and human resources. The top executive or top executive team is the architect of the strategy or vision (which develops over time), and this vision is implemented politically through building credibility, broadening support, systematic waiting, and managing coalitions.

Noda and Bower (1996) describe research, primarily by Burgelman (1996), that investigates how strategic initiatives "emerge" from managerial activities of front-line and middle managers (or from virtually anywhere people have the capacity to learn and the resources to support that capacity). Top managers merely exercise critical influences by setting up structural context (organizational and administrative mechanisms, such as measurement systems, reward systems, organizational structure) to reflect corporate objectives, thereby manipulating the way decisions and actions of lower-level staff members are made. This is sometimes called a "grassroots model" of strategy formation and is part of the "learning school" approach to strategy (Mintzberg et al. 1998:196).

The literature also discusses strategy formation as a process of negotiation, focusing on the role of power relations in strategy development. Mintzberg et al. (1998:236) assert: "Introduce any form of ambiguity – environmental uncertainty, competing goals, varied perceptions, scarcity of resources – and politics arises." Along these lines, Bolman and Deal (1997:163) claim that: "Goals and decisions emerge from bargaining, negotiation, and jockeying for position among different stakeholders." Regarding strategic maneuvering, Porter (1980:91) contends: "Many moves that would significantly improve a firm's position do threaten competitors…. Thus a key to success … is predicting and influencing retaliation." Cooperation is also a potential offshoot of power relations. Astley and Fombrun (1983) coined the term *collective strategy* to describe the joint nature of strategy formation among interdependent companies or networks (e.g., efforts within the banking industry to develop ATMs).

In a recent book, Markides (2000) stresses that the process of developing superior strategies is part planning and part trial and error. He argues that a company must develop its strategy by asking "Who should we target as customers, what should we offer them, and how should we go about it?" They should "…raise these questions, identify possible answers, evaluate the answers, and make a choice. The objective should be to come up with ideas that differentiate the firm from its competitors. Therefore, the more creative the ideas, the better." He asks, "Do creative new strategies emerge from planning, or is something else involved?" He concludes, "Analysis and planning will not produce a full-fledged strategy ready for implementation, but they will help narrow the options. Experimentation should then follow on that limited set of options, out of which the final strategy will emerge" (Markides 2000:147-149).

Hamel (1996, 2000) contends that radical strategy innovation has now become paramount. He claims that the current environment is hostile to industry incumbents and hospitable to industry

revolutionaries. The fortifications that protected the industrial oligarchy have crumbled under the weight of deregulation, technological upheaval, globalization, and social change. What is now required to ensure organizational success is to continually revolutionize the basic organizational strategy, which involves:

- Radically reconceiving products and services, not just developing new products and services
- Redefining market space
- Redrawing industry boundaries.

To achieve this, organizations need to develop an innovation competency directed at continually rethinking and revolutionizing its strategy from top to bottom. D'Aveni (1994:31) proposes a framework based on what he calls the "Seven S's:"

- Superior stakeholder *s*atisfaction
- Strategic *s*oothsaying
- Positioning for *s*peed
- Positioning for *s*urprise
- *S*hifting the rules of competition
- Signaling the *s*trategic intent
- Simultaneous and sequential *s*trategic thrusts.

Tools Used in Strategy Development

This section very briefly describes several key tools that can be used during the course of strategy development and strategic planning. The list is not intended to be comprehensive but to illustrate the types of tools that are available.

- **Environmental scanning (or competitive intelligence)** is a rigorous approach to collecting, analyzing, and communicating information about competitors' activities, market changes that are occurring, changes related to the supply of raw materials, and other issues that could affect strategic directions. Such information is legally and ethically obtained from a wide range of sources using formalized techniques and can be factored into decision making, e.g., to support the application of the "five-forces" model or other frameworks for developing strategy. (See Herring 1993; Ashton and Klavans 1997 for explanations of competitive intelligence related to science and technology.)
- **Scenario planning and forecasting** helps planners deal with an uncertain future by providing a mechanism for envisioning a range of future scenarios, examine the possible impacts of them, develop a common view of the changing world, and prepare for it. Scenarios sometimes are best used not as a basis for strategy, but as a way to improve how managers do it (Mintzberg et al. 1998:59). For a classic example of how Royal Dutch/Shell used scenario planning and was prepared for the eventuality, if not the timing, of the oil crisis of 1973, see the article by Wack (1985).
- **Capital planning and budgeting** is the process by which unit managers (e.g., division directors) propose individual projects up the hierarchy for approval. This usually involves cost/benefit assessment of each proposal (combined into a return-on-investment measure), allowing senior managers to compare and rank them, and accept only as many as the capital funding allows. This is sometimes called "bottom-up" strategic planning. However, Mintzberg (1994) argues that most proposals with sponsorship from a division

director have more or less free passage (a "rubber stamp"), that the analysis is rarely unbiased, and that the hard-to-quantify costs and benefits are excluded.

- **Portfolio analysis** is a technique, similar in some respects to capital budgeting but usually at the business rather than project level, used to examine the relative value of the various businesses, subsidiaries, or other units within a company, and to determine if a balanced "mix" has been achieved. This helps corporate-level planners reach a better understanding of the competitive position of the overall portfolio of businesses, to suggest strategic alternatives for the businesses, to understand the value of acquiring new businesses, and, overall, to develop priorities for resource allocation. Often, this is done through use of **portfolio matrices,** a set of graphic displays that help managers visualize the portfolio along two dimensions: usually an external dimension related to the overall attractiveness of the industry, and an internal one that relates to the strength of the business within that industry (see Hax and Majluf 1996:276-322).
- **Roadmapping** is a technique used by many companies, including high-tech firms such as Motorola (Willyard and McClees 1987) to plan **new product development**. Lately, the term "roadmapping" has been broadly applied to many kinds of planning activities underway in industrial firms, industry collaborative groups, and government agencies. These organizations are producing many types of roadmaps, including product or product line roadmaps, sales roadmaps, industry roadmaps, and technology roadmaps.
- **Game theoretic modeling** is the analysis of rational behavior in situations involving interdependence of outcomes, a technique sometimes used to improve development of a competitive strategy by addressing such microeconomic issues as the importance of first-mover advantages and the role of commitment, reputation formation and exploitation, signaling, and the strategic control of information (Saloner 1994:155-156; Camerer 1994:195). Game theory involves looking forward and reasoning backward to formulate a strategy that has the best chance of leading to the desired outcome in situations where that outcome is dependent upon the decisions of others as well as one's own (Brandenburger and Nelebuff 1995). It provides a way to analyze key strategic decisions concerning cooperation, coordination, and differentiation (Kay 1995). However, the applicability of the assumptions underlying game theoretic modeling, especially the degree of rationality, complex reasoning, and learning of the participants, has been challenged, raising questions about the usefulness of game theory in dynamic, real-life situations. Consequently, game theory has been found more useful as a metaphorical tool that can provide insights into patterns of behavior likely to occur under different circumstances than as a literal analytic model (Grant 1995; Kay 1995).
- **Stakeholder analysis and engagement** is related to game theory in that it emphasizes the importance of identifying, understanding, building relationships with, and satisfying key stakeholders, both inside and outside the boundaries of the organization. Harrison and St. John (1998:8) categorize stakeholders into those within the organization (owners/board of directors, managers, and employees) and within the operating environment (customers, suppliers, government agencies and administrators, unions, competitors, financial intermediaries, local communities, and activist groups), all operating within the broader environment subject to sociocultural, global economic, and global political/legal forces and technological change. Stakeholder analysis involves understanding the interests and concerns of the various stakeholders relative to the potential strategies and activities of the organization. Stakeholder analysis is usually coupled with an effort to engage stakeholders in a way that builds relationships, meets disclosure of information requirements in a positive way, and maximizes the potential to motivate behavior beneficial to the organization.

- **Decision science and decision analysis** was developed as a recognized field of study in the 1960s and 1970s at Harvard, Stanford, MIT, Chicago, Michigan, and other major universities. It is generally considered a branch of the engineering discipline of Operations Research, but also has links to economics, mathematics, and psychology. The theoretical foundations of decision analysis are a set of axioms that imply that the desirability of alternative courses of action depends on the likelihood of possible outcomes and the preferences for those outcomes. Likelihood is estimated using probability distributions and desirability is measured using utility functions. Probabilities and utilities are used to calculate the expected utility of each alternative. Alternatives with higher expected utilities should be preferred. Subjective judgments by subject area experts are often used to determine probabilities and utilities and an effort is made to deal explicitly with uncertainty (Morgan and Henrion 1990). Clemen (1995), Hammond et al. (1999), and House and Shull (1988) provide clear descriptions of the various tools used in decision analysis.

Problems with Strategic Planning

While most authors agree that a well-formulated strategy provides direction, helps focus efforts, and provides consistency to employees, and hence gives the organization advantages, another school of thought contends that a *deliberate absence* of strategy may promote creativity and flexibility in an organization (see for example, Inkpen and Choudhury 1995:313-323). Tightly controlled organizations with high reliance on formalized procedures and a passion for consistency may lose the ability to innovate and may hence become less successful. One example of the deliberate absence of strategy is the company Nucor, which has no written strategic plan, no written objectives, and no mission statement. Their absence is symbolic of the non-bureaucratic, flexible, learning organization Nacor has worked hard to become. So, at one end of the spectrum, some people believe strategy itself is deleterious to an organization's success. But focusing on strategy does not necessarily have to prevent creativity and flexibility. Hamel (2000) claims that developing an innovative strategic competency is the critical factor for ensuring future organizational success.

Although criticism has been directed at almost all theories or models of strategy development, most criticism has focused on the formalized, strategic planning processes that Mintzberg et al. classify as the "planning school" approach. These criticisms can be summarized as follows (derived from Mintzberg et al. 1998:65-77; and Mintzberg 1994):

- *Products of planning often aren't used.* For example, a 1997 survey of 50 companies found that over 20 had developed a SWOT analysis, yet "no one subsequently used the outputs within the later stages of the strategy process" (Hill and Westbrook 1997:46), prompting the researchers to write an article entitled, "SWOT Analysis: It's Time for a Product Recall."
- *Planning processes can dominate the staff.* Methodologies can become very elaborate and time consuming, with too much emphasis on analysis and too little on true strategic insights.
- *The implementers are often excluded from the process*. New organizations are sometimes created just to conduct the planning, often cutting executives out of the strategy development process.
- *Planning processes often fail to develop true strategic choices.* Planners sometimes adopt the first strategy that meets certain basic conditions in an acceptable manner. They

make no real effort to search for or analyze an array of strategy alternatives before making a decision.

- *Forecasts are invariably wrong.* Strategic planning requires stability during, and predictability following, strategy making. However, disruptions and discontinuities are a fact of life. Planning cannot do much other than extrapolate the present trends and hope for the best.
- *"Hard" data used in strategic planning lack the richness needed to make strategic decisions.* The strategic planning "system" is supposed to be detached and objective and relies on detailed "facts" about the organization and its context. But hard information is often limited in scope and fails to encompass important non-economic and non-quantitative factors. It can be too aggregated for effective use, often arrives too late to be of use, and is sometimes unreliable and subject to biases.
- *Innovation cannot be institutionalized.* Strategic planning is not always viewed as an aid to strategic thinking or strategy making (as perhaps it should be), but as a replacement for intuition and creative thinking. The thinking of genius entrepreneurs is hard to replicate in a formalized, institutionalized process. Strategy making is "a complex process involving the most sophisticated, subtle, and at times subconscious of human cognitive and social processes" (Mintzberg et al. 1998:73).
- *Strategic planning is not strategy making.* Mintzberg et al. (1998:77) contend, "Planning, rather than providing new strategies, could not proceed without their prior existence. Strategic planning has been misnamed. It should have been called strategic programming."

Despite the pitfalls and constraints of detailed and routinized strategic *planning*, most academicians, industry analysts, and corporate executives believe that organizational strategy is important. The thing to keep in mind is that strategy cannot be reduced to strategic planning processes, especially at the upper levels of the organization. Strategic planning is better used to ensure strategic alignment and coordination across levels and groups, than to develop innovative strategy directions.

Strategic Planning in Government Agencies

Profitability and shareholder value are the drivers behind private sector planning exercises. Firms ask, "How can we capture more market share? What new markets should we go after? What innovative products should we be developing?" Government agencies, unlike private sector firms, sometimes struggle with defining and measuring "the bottom line." Rather than achieving the goal of profitability, government agencies must ask: "How should we be better serve the American public? How do we measure success?" The answers aren't always simple, and that makes strategy development more elusive. Even a focus on "customers" may not be particularly helpful to government agencies, since the members of the public served by federal organizations are to some extent a captive group (i.e., the services they receive are not available anywhere else) and they are not making simple buy-no buy decisions.

About the time GE and other organizations were beginning to implement detailed, data-intensive strategic planning processes, the US Department of Defense, under the leadership of Robert McNamara (during the Kennedy years) embraced a system called Planning-Programming-Budgeting System (PPBS), which later infiltrated the entire US Federal government as well as State and foreign governments and, to some extent, industry (e.g., Air Canada used it). The intent

was to base planning on "outputs" rather than "inputs," and to focus on missions or strategic thrusts (e.g., civil defense, or retaliation forces) rather than on internal functional or structural divisions such as the Army, Navy, or Air Force. The process included (1) formulating objectives, (2) relating program outputs (favorable impacts) to the objectives, (3) relating outputs to program inputs in dollar terms, (4) aggregating outputs into total benefits over the entire lifetime of the program, (5) similarly aggregating inputs into total costs, (6) establishing benefit-cost ratios, and (7) comparing benefit-cost ratios of existing and proposed programs in order to choose among them. The process was "supposed to generate strategic thinking as well as enable strategic planning to be tied to capital and operational budgeting" (Mintzberg 1994:117). It was used during the Vietnam War era in attempt to make strategic decisions, but by 1974, Aaron Wildavsky (author of the acclaimed book, The *Politics of the Budgetary Process* 1974:205) wrote, "PPBS has failed everywhere and at all times."

More recently, Bryson et al. (1986:73) found at least five different models of strategic planning applied in government settings, with the Harvard SWOT Model and the Stakeholder Model the most commonly used approaches to strategic planning in the public sector (also see Bryson and Roering 1987, 1988.) Similar to its use in the private sector, the Harvard SWOT Model helps government planners assess organizational strengths and weaknesses, identify opportunities and threats, and attempt to co-align the organization with its environment. Nutt and Backoff (1992) also discuss this approach and encourage organizations to build on strengths, overcome weaknesses, exploit opportunities, and block threats. Stakeholder approaches (e.g., see Freeman 1984; and Mason and Mitroff 1981) focus on identifying individuals and organizations with an interest (or "stake") in the agency. A stakeholder focus for organizational strategic planning activities aims to maximize stakeholder support for, or minimize their opposition to, agency initiatives. An even more recent national survey examining the experience of State agencies with strategic planning (Berry and Wechsler 1995) found that a majority of State agencies use some type of strategic planning or analysis to set program and policy direction and to respond to budgetary pressures (among other reasons), but did not collect information about the types of strategy approaches used.

By partnering with leading edge private sector companies, the Federal Benchmarking Consortium (1997)[4] investigated how best practices in customer-driven strategic planning could be applied in the Federal government. They found that the Government Performance and Results Act of 1993 drives many of the planning activities, requiring federal agencies to develop strategic plans for how they will deliver high quality products and services to the American people (see Chapter 6, "Performance Assessment"). They also found that the "best-in-class" organizations use "aggressive and varied ways to locate and listen to the 'Voice of the Customer,'" ranging from simple (such as point-of-service response cards) to sophisticated (e.g., technologist advisory panels) methods. These approaches help organizations improve products and services for current customers, as well as to identify and develop new customers.

[4] Note that James Cavanagh and Dolores Livingston of the US Department of Energy were the benchmarking study team leaders, and that the team members included managers from the Defense Mapping Agency, Internal Revenue Service, Department of Veterans Affairs, National Highway Traffic Safety Administration, Coast Guard, Department of Justice, General Services Administration, Bureau of Engraving and Printing, Social Security Administration, Department of Education, Patent and Trademark Office, Department of Transportation, Department of the Treasury, Department of the Navy, and National Aeronautics and Space Administration. Benchmark study partners included: Ameritech, American Society for Quality Control, BancOne, Chevron, City of Phoenix, City of Sunnyvale, Commonwealth of Virginia, Corning, Dupont, Florida Power and Light, GTE, Intel, Johnson and Johnson, Motorola, Southern California Gas, Wisconsin Electric Power, and Xerox.

Some of the other results of the Federal Benchmarking Consortium's study show that the best-in-class organizations:

- Rely on core organizational values (guiding principles) to drive the organization
- Have senior leaders who "own" their strategic planning processes
- Employ a consistent, well-understood, and structured planning process across all levels of the organization (this does not have to be cumbersome and highly routinized)
- Use effective internal communication to link planning to practice
- Have a sense of urgency about customer focus
- See planning as a continuous process, and think the process is more important than the product
- Recognize that the commitment of their people to an organizational ideal is a necessary ingredient of success
- Tie performance measurement to incentives and compensation and require accountability for results
- Understand that customer-driven strategic planning is linked to culture change.

These findings may help government agencies develop more effective strategic planning processes focused on better service to their customers.

The Application of Strategy to Public Science Management

Like the complex, formalized processes in the private sector, many government attempts at rigorous, formal planning have met with limited success (some would more bluntly characterize them as failures). Other efforts have been more successful. The federal benchmarking study on customer-focused strategic planning offers good advice for avoiding many of the pitfalls of strategic planning. It recommends that the focus of strategic planning in governmental organizations should be on better understanding the "customers" of government and developing strategies to meet their needs. These strategies should be developed through a structured, if not always routinized, process and based on sound principles, such as development of core values, strong leadership from senior executives, a focus on the urgency of customer service, and good internal communication. Public science management will have to also address the extent to which their strategies may need to be creatively innovative, flexible, learning-oriented, stakeholder-oriented, and/or collective.

Also Hamel and Prahalad's concept of core competencies could be applied, along with the idea that those competencies should be developed in directions needed by the 'market' (in this case, society's science needs). Analysis of "competitors," per Michael Porter, could provide another direction for strategic development. One could consider industry competition (and potential collaboration) with the federal science "industry" (i.e., federal agencies vying for Congressional appropriations in competition), and conduct a "Five Forces" analysis that examines the power of customers (e.g., offices within the agency who use research results or Congress itself), the power of suppliers (e.g., National Laboratories, Universities), the threat of new entrants (new government agencies or new areas of science that might compete for research dollars), and the threat of substitute products (e.g., health care substituting for science in the federal agenda). Tools such as competitive intelligence, roadmapping, scenario planning, portfolio analysis, and capital budgeting could also be applied within the public science enterprise with potentially beneficial results.

Relevant questions for managers of publicly funded science organizations include:

1. How does strategy tend to be formulated and developed within the various public science management (funding and directing) organizations? What are the major differences and common strengths/weaknesses?
2. Is there a need for more collective strategy formulation across these public science management organizations? If so, how could this be accomplished?
3. How does strategy tend to be formulated and developed within the various public science implementing organizations? What are the major differences and common strengths/weaknesses?
4. Is there a need for more collective strategy formulation across public science management organizations and public science implementing organizations? If so, how could this be accomplished?
5. Is there a need for greater collective strategy formulation between public science management organizations, private science organizations, and/or universities? If so, how could this be accomplished?
6. How can the country's overall science strategy best serve public science needs and priorities?
7. What appear to be the most useful strategy approaches and tools for public science management organizations (collective approach, game theory, negotiation, Five Forces, SWOT, roadmapping, etc.)? How can the strategy processes of public science management organizations be improved in the near term? Longer term?
8. How can the strategy processes of public science implementing organizations be improved in the near term? Longer term?

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